Transportation Brokerage Services and Medicaid Beneficiaries' Access to Care

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ABSTRACT

JINKYUNG KIM: Transportation Brokerage Services and
Medicaid Beneficiaries' Access to Care
(Under the direction of Edward C. Norton, Ph.D.)

This dissertation investigates the effects of transportation brokerage services on Medicaid beneficiaries' access to care. Medicaid pays for non-emergency medical transportation services to help vulnerable patients with transportation needs. The intended effect of transportation brokerage services is to provide reliable transportation at minimum costs. The study period from 1996 to 1999 corresponds to the period of a natural experiment during which Georgia and Kentucky implemented transportation brokerage services. Individual-level data were used to measure changes in use and expenditures of Medicaid services. Three study populations, which are transportation users, children with asthma, and adults with diabetes, were identified to capture possible effects. A difference-in-differences model was used to assess the effect of transportation brokerage services on Medicaid beneficiaries' access to care. The design is strengthened by the staggered implementation dates between states and within each state. Results show that the implementation of transportation brokerage services had significant effects on Medicaid beneficiaries' access to care, measured by Medicaid expenditures and health services use. The effects differed by type of Medicaid services and by medical conditions. Results for ambulatory care sensitive conditions admissions and ER use due to medical conditions suggest that adults with diabetes were better off under transportation brokerage services while the effects for children with

asthma were inconclusive. Findings from this analysis could help guide policy modifications that support the reliable provision of non-emergency medical transportation services.

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LIST OF ABBREVIATIONS

ACSC	ambulatory care sensitive condition
CMS	Centers for Medicare & Medicaid Services
HCFA	Health Care Finance Administration
HMO	Health Maintenance Organization
NEMT	non-emergency medical transportation
OIG	Office of the Inspector General
OLS	ordinary least squares
PCCM	Primary Care Case Management

EXECUTIVE SUMMARY

Introduction

Transportation is a particularly important issue for Medicaid beneficiaries because most Medicaid beneficiaries are low-income and may not help getting to a healthcare provider. States are concerned with non-emergency medical transportation as a means of assuring that Medicaid beneficiaries can access needed healthcare services, and also because of the need to control costs. By 2001, 21 states adopted transportation brokerage services on a capitated basis for Medicaid beneficiaries to reduce expenditures and improve quality (Rafael 2001) Transportation brokerage services mean that states contract with brokers to manage non-emergency transportation services for Medicaid beneficiaries. The goal of transportation brokerage services is to provide reliable transportation for Medicaid beneficiaries at minimum cost; in other words, the aim is to increase efficiency without decreasing access to care.

Transportation brokerage services are, however, new enough that little substantial analysis has been conducted on the effects of this change in payment system on overall Medicaid expenditures. This dissertation examined how transportation brokerage services affect beneficiaries' access to care, measured by type of Medicaid expenditures and by different group of beneficiaries.

Research Questions

I addressed two research questions, one related to Medicaid expenditures and one related to health services use.

1. Have Medicaid expenditures, as measured by type of medical and transportation-related expenditures, been affected as a result of transportation brokerage services? This general research question encompasses three hypotheses:
    - The direct effect of transportation brokerage services on transportation-related expenditures and use vary by group of beneficiaries
    - The spill-over effects on Medicaid expenditures and use vary by type of Medicaid services
    - The spill-over effects vary by selected medical conditions.
2. Have transportation brokerage services affected beneficiaries' health services use? One hypothesis stems from this research question:
    - Transportation brokerage services decrease beneficiaries' certain health services use that indicates inappropriate health services use and decreased access to an appropriate site of care.

Data

Using Medicaid data from two states, Georgia and Kentucky, from calendar year 1996 to 1999, monthly individual-level expenditures and services use were constructed. To capture possible different effects on Medicaid services, three study populations are identified: users of transportation services, children with asthma, and adults with diabetes. The study populations were restricted to beneficiaries who were eligible at least one month in both pre- and post-periods to reduce issues of selection. Individuals who lived in counties with full-risk capitated health maintenance organization (HMO) were also excluded because of a selection issue and the absence of encounter data in Medicaid claims files.

<u>Methods</u>

The staggered implementation of transportation brokerage services in Georgia and Kentucky provide a natural experiment. A difference-in-differences model was used to estimate the effects of transportation brokerage services, a design that allows the separation of the policy effects from general trends in study states. The design was strengthened by the staggered implementation dates between states and within a state. A two-part model was used to predict the effect of transportation brokerage services on monthly Medicaid expenditures, controlling for personal characteristics and time trends. The dependent variables of interest are medical (i.e., total, inpatient, outpatient, prescription drug, other, emergency room) expenditures and transportation-related (i.e., non-emergency medical transportation and ambulance) expenditures. For the analyses of health services use, a linear probability model was used to predict the probability of having ambulatory care sensitive condition (ACSC) admission and emergency room use due to specific medical conditions.

<u>Results</u>

Transportation brokerage services were associated with changes in Medicaid expenditures and health services use. The expenditures for non-emergency medical transportation services showed a statistically significant decrease among transportation users and adults with diabetes, however, there was a statistically significant increase in non-emergency medical transportation expenditures for children with asthma. The use of transportation by ambulance in all study populations decreased, but was statistically significant only in transportation users and children with asthma.

Different magnitude and direction of spill-over effects on medical expenditures were found by medical conditions. For both children with asthma and adults with diabetes, the increased use of any health care services accompanied with decreased expenditures, conditional on any use, led to a decrease of monthly total expenditures by $18 per person. The probability of using outpatient services increased in both study populations while the probability of using inpatient services decreased only in children with asthma.

Results for health services use showed that the access to care among adults with diabetes improved under transportation brokerage services—decreases in ACSC admissions—while the result is not supportive among children with asthma.

Discussion

The findings provide evidence that the shift to transportation brokerage services positively affected the access to care among Medicaid beneficiaries: increased use of health care services accompanied with decreased associated expenditures. Many states are implementing, or plan to implement, transportation brokerage services to reduce expenditures and improve quality. The results from this study can inform the policy debate on how to manage non-emergency medical transportation services and whether to expand transportation brokerage services.

CHAPTER 1. BACKGROUND AND SIGNIFICANCE

History of Non-Emergency Medical Transportation

Non-emergency medical transportation (NEMT) services are federally-mandated Medicaid services to meet the transportation needs of vulnerable populations. In 2001, ten percent of the Medicaid population, about 4 million beneficiaries, relied on the transportation services to get to medical appointments (Rafael 2001). While approximately one percent of states' Medicaid budgets are spent on NEMT, it was estimated that NEMT costs increased ten percent a year nationally during the 1990s (Rafael 2001; OIG 1997). Despite being a small percentage of total Medicaid expenditures, non-emergency medical transportation services are a particularly important issue for Medicaid both because access to care for this vulnerable population is affected and because states are concerned with controlling costs.

Many states were concerned that cost basis payment system for NEMT used historically may limit access and increase the risk of fraud . Several reasons for escalating transportation costs were noted. Transportation providers typically billed Medicaid based on reported trips and miles. The amount of transportation-related fraud became a concern of state Medicaid agencies because the revenues of transportation providers mainly depend on how many trips and miles they report. To get higher reimbursement, providers could generate phantom trips, inflate mileage, and misclassify eligible clients as disoriented or non-ambulatory patients who have higher reimbursements. Absence of oversight—such as prior authorization and verification of provided services—further exacerbated the possibility of transportation-related fraud and abuse.

Transportation would especially matter to beneficiaries in underserved areas, where public transportation is limited and distance to medical care is far. Access to transportation services could also be limited if transportation providers operate only in profitable areas. Competition in urban areas for profits may divert many unprofitable residents away from reliable provision of transportation. Finally, inefficient and limited provision of NEMT services could reduce the use of timely medical care, and potentially increase Medicaid expenditures via delayed and expensive care. For state Medicaid agencies, reducing unnecessary costs without limiting needed services is a challenge.

In response, by 2001, 21 states adopted transportation brokerage services on a capitated basis for Medicaid beneficiaries (Rafael 2001). The intended effect of transportation brokerage services is to provide reliable transportation at minimum costs. The trend toward transportation brokerage services raises two important policy questions. One is whether transportation brokerage services reduce expenditures, either directly on transportation services or indirectly on other Medicaid services. The other is whether transportation brokerage services reduce beneficiaries' use of certain health services, which can indicate improved access to appropriate care accompanied with any change in expenditures.

Description of Transportation Brokerage Services

Transportation brokerage services mean that states contract with brokers (i.e., profit or non-profit organizations) to manage NEMT services for Medicaid beneficiaries. The brokers are responsible for efficient provision of reliable transportation and are reimbursed by capitated rates. The brokers negotiate payment rates with transportation providers, verify beneficiaries' service eligibility, decide the necessity of trips, reserve timely transportation, remind patients about appointed trips in advance, educate patients about available transportation options, and monitor quality of services (Kim and Norton 2004; Rafael 2001; Kulkarni 2000). When a beneficiary calls transportation brokers, his service eligibility is first verified because not all Medicaid beneficiaries are eligible for NEMT. For example, nursing home residents and State Children's Health Insurance Program enrollees are not eligible. For those who are enrolled in Medicaid managed care plans, transportation services are covered under managed care benefits unless the services are carved out.

Before transportation brokerage services were implemented, Medicaid funding for NEMT services was strictly cost-based. Under transportation brokerage services, the capitated rates are adjusted for differences in beneficiaries' health (e.g., disabled) and whether they live in an urban area. Brokers can use various transportation modes, but searching for the least expensive one among available options is the key to increase the efficiency. Shifting financial accountability to brokers not only increases efficiency but also improves the quality of services and the satisfaction of beneficiaries (O'Connell, Grossardt, et al. 2002; OIG 1997).

The success of transportation brokerage services depends, in part, on the expanded availability of transportation in underserved areas. To increase access to care in underserved areas, brokers' efforts to reach out to eligible beneficiaries include providing user-friendly trip reminders, giving out public transportation schedules, and educating the available transportation options. These brokers' efforts could increase the use of transportation services in some areas after the implementation of transportation brokerage services.

Evidence from Related Literature

Two related areas of research offer some background on the effect of transportation brokerage services: the use of ambulances as an alternative to non-emergency transport and the lack of transportation as an access barrier to medical care. Provision of reliable transportation services matters most to those who do not have timely available transportation options. Studies using survey data from one city or several hospitals in one state found that Medicaid beneficiaries, who are less likely to have transportation options, tend to use more unnecessary ambulance trips than other health insurance groups do (Billittier, Moscati, et al. 1996; Brown and Sindelar 1993). Brown and Sindelar (1993) determined that ambulance misuse systematically varied by types of health insurance: from total of 144 cases, the appropriate use of ambulance was found in only 15% of Medicaid patients compared to approximately 80% of patients with private insurance. Another study found that the inappropriate use of ambulance was significantly associated with age below 40 (Billittier, Moscati, et al. 1996). Using a multisite survey in New York state, the most common reason for using ambulance transport was lack of an alternative transportation. Billittier and colleagues also found that only 22% of the respondents attempted to contact their doctors before requesting an ambulance. The Medicaid pediatric population also showed a similar pattern of ambulance misuse (Broxterman, Sapien, et al. 2000; Murdock, Knapp, et al. 1999; Camasso-Richardson, Wilde, et al. 1997): children with Medicaid, in low-income zip code areas, and in non-inner metropolitan areas are associated with repeated ambulance use. These findings suggest that lack of appropriate transportation is more likely to increase the use of unnecessary ambulance and expensive emergency room services. Previous research on ambulance misuse among Medicaid beneficiaries supports the idea that less resourceintensive transportation option should be offered to meet the needs of the vulnerable population.

Many studies examined factors affecting the use of medical services. Findings from those studies show two distinctive effects of a lack of transportation: more use of an emergency department and less use of preventive and primary care. When transportation to clinics is not easily available, health care use for regular check-ups and chronic care is less likely to be made and the visits to an emergency department is more likely to become a primary source of care (Arcury, Gesler, et al. 2005; Johnson and Rimsza 2004; Wilson and Jonathan 2000). These associations are particularly significant to those who live in rural areas, and are also found for certain medical care services such as filling prescription drugs and pediatric dental care (Mofidi, Rozier, et al. 2002; Saunders 1987). The provision of and access to reliable transportation increases the likelihood of primary care physician visits in the pediatric population (Johnson and Rimsza 2004), HIV-positive adults (Messeri, Abramson, et al. 2002), and frequent emergency room users (Baren, Shofer, et al. 2001; Nemet and Bailey 2000). Overall, these studies suggest that the provision of reliable transportation services is important to enable patients to get to regular and preventive care. Although the literature on access to care and health care utilization offers a starting point, it clearly leaves a gap to be filled if the effects of transportation brokerage services on Medicaid beneficiaries' access to care and health outcomes are to be understood.

Potential Effects of Transportation Brokerage Services on Medicaid Beneficiaries' Access to Care

A review of the literature suggests that brokers promote use of the least expensive transportation mode and increase access to care in previously underserved areas. Positive effects on cost savings and quality improvement were reported in those states that adopted transportation brokerage services (Dai 2005; O'Connell, Grossardt, et al. 2002). A county in Kentucky, in which 15,000 annual trips were reported in the past, had only 4,500 annual trips after transportation brokerage services began. In Georgia, beneficiaries with limited transportation options in the past were better able to get to medical appointments. Brokers are paid per person and therefore have an incentive to decrease cost per trip by finding efficient transportation modes. The net effect is that many beneficiaries can use transportation services and brokers can invest in the capacity to provide for more beneficiaries in underserved areas. Thus, despite the use of the small percentage of Medicaid beneficiaries, the financial change brought about by capitation is by no means trivial to states' Medicaid programs.

The goal of the new system is to increase efficiency without decreasing access to care, but little substantial analysis has been done on the effects of these payment changes on beneficiaries' outcomes. One recent study using Florida data suggests that transportation brokerage services are associated with substantially decreased unit cost per trip and more accountability, but the effect on beneficiary-level outcomes was not established (Dai 2005). One of the few academic, empirical studies published to date on the issue studied the effect of prior-approval requirement for Medicaid transportation services in Indiana found a decrease in primary care visits and prescription refills, but did not find any measurable short-term effects on health outcomes (Tierney, Harris, et al. 2000). However, the relatively short study period to assess health outcomes—six months each in the pre- and post periods—and the limited study sample (from just one large hospital) may hinder the determination of true effect of the changes in the system. In order to comprehensively assess the effect of transportation brokerage services on access to care and health outcomes of Medicaid beneficiaries, using a longitudinal panel data of the study population with various measures of health services use and outcomes seems indispensable.

Significance

There has been much discussion in the media and in the government about transportation-related fraud and abuse. There has also been some discussion as to whether or not transportation brokerage services led to decreased non-emergency medical transportation expenditures and increased access to care for some Medicaid beneficiaries. There has been increasing discussion but little actual research, however, of the effect of transportation brokerage services on the use of other Medicaid services and beneficiaries' health outcomes.

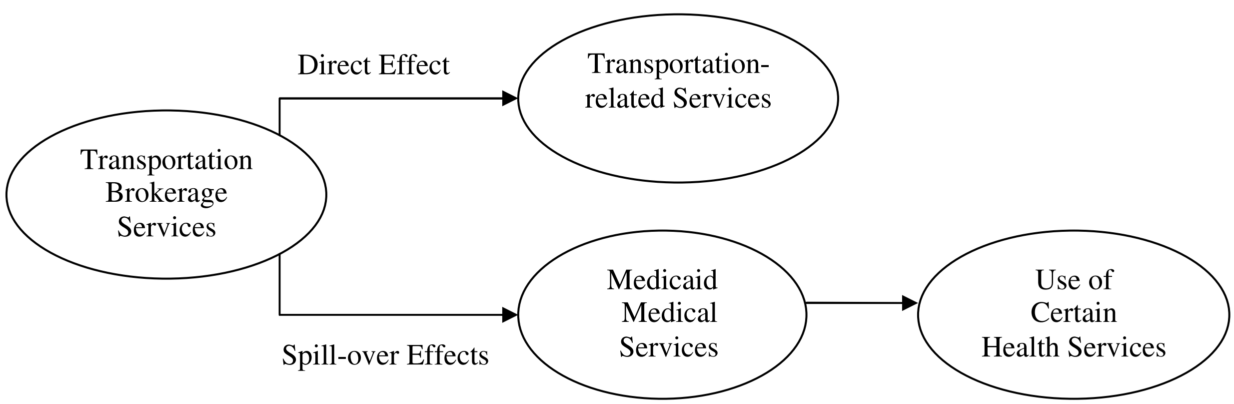
This study, therefore, provides insights into the Medicaid beneficiaries' access to care under capitated rates for non-emergency transportation services. Results from this study could be used to inform the policy debate on future decisions about whether to expand transportation brokerage services. In sum, this study of transportation brokerage services fills an important gap and adds to research in the field in five major ways:

1. It assesses the direct effect of transportation brokerage services on the use and expenditures of transportation-related services,
2. It analyzes the spill-over effect of transportation brokerage services on total Medicaid expenditures and use,

3. It examines possible differential effects across medical conditions: profiling various study populations according to their medical conditions will provide differential effect of transportation brokerage services on heterogeneous Medicaid beneficiaries,
4. It utilizes individual-level longitudinal data to provide better understanding of the effect on health outcomes, and
5. It uses econometric methods that allow for identification of the effects of transportation brokerage services separately from other trends in states.

CHAPTER 2. CONCEPTUAL FRAMEWORK

The conceptual framework posits that transportation brokerage services can affect beneficiaries' access to care both directly and indirectly. The direct effect on transportation-related services occurs through changes in the price and quantity of transportation brokerage services. Spill-over (i.e. indirect) effects are those that may occur with changes in the use of other Medicaid services. The diagram below illustrates the direct and indirect effects of transportation brokerage services.



Because the transportation brokerage company can negotiate lower prices with most transportation providers, the direct effect on use and expenditures of transportation-related services could be either positive or negative. For example, taxi drivers have an incentive under fee-for-service not to take the shortest path. Transportation brokerage services may improve the ability for some Medicaid beneficiaries to use transportation, and may reduce the need for other beneficiaries. The reliable provision of NEMT would further reduce unnecessary ambulance transport.

Reliable provision of transportation services would increase access to care for some services such as outpatient care and pharmacy use. Increased use of such services would also increase associated expenditures, however, it could lead to a decreased use of delayed and relatively expensive inpatient and emergency room services. It is expected that the indirect effects of transportation brokerage services on the use of medical services could vary by type of medical services. The combined direct and indirect effects, then, ultimately affect beneficiaries' health status. A full assessment of transportation brokerage services then depends on comparing changes in health status to the change in total expenditures. A decrease in total (transportation and medical) expenditures accompanied by an improvement in outcomes would be unambiguously good; other combinations would merit further judgment.

Theoretical perspective

In theory, preventive and primary care could be a substitute or a complement to inpatient and specialty care. If transportation brokerage services promote the use of timely preventive and primary care, the effects are not just limited to expenditures and use of these services. Whether preventive and primary care is a complement for inpatient care is important in the study because overall health care expenditures could increase with better access to care. Some studies suggest that primary care could be a complement with other types of health care services. First, some services such as diagnostic tests are in fact ancillary to primary care. Second, some diseases such as cancer and serious mental illness can be detected and identified in primary care settings, but are treated effectively in specialty care settings. The last is more likely to be relevant for persons with chronic health conditions who delay timely and necessary preventive and primary care.

The RAND Health Insurance Experiment, in which participants were randomly assigned to receive different health benefits, indicated that the insurance group with free ambulatory care did not have a significantly higher number of inpatient admissions than the group with a $150 deductible for ambulatory care. This experiment suggests a complementary effect between ambulatory and inpatient care (Manning, Newhouse, et al. 1987). A multisite VA experimental study found that veterans with chronic conditions who were randomly assigned to an intensive primary care treatment intervention after hospitalization had a higher probability of readmission compared to the control group (Weinberger, Oddone, et al. 1996).

Alternatively, the benefit of increasing access to care through transportation brokerage services may depend on whether preventive and primary care visits can substitute for more costly inpatient care without any compromise in health outcomes. Substitution of primary care for inpatient services may occur with a number of ways. First, preventive care that can be offered in primary care settings may avoid the need for inpatient care (Donaldson, Yordy, et al. 1996; Starfield 1996). For example, early treatment and prevention of exacerbations of asthma could prevent hospitalizations. Second, management of chronic disease conditions could delay inpatient care (Starfield 1996). Controlling blood sugar of diabetes patients to avoid kidney failure can be an effective chronic disease management in primary care settings. Third, primary care physicians could act as a gatekeeper in reducing inpatient and specialty care (Starfield 1994).

Some studies on substitution effects show that access to and use of primary care reduce emergency department visits, specialty care or inpatient care. Free primary care to the pediatric population reduces emergency department visits, but has no effect on inpatient admissions (Davidson et al. 2003). Using a VA diabetes population, Maciejewski and Maynard (2004) argue that outpatient clinic visits appear to substitute for inpatient care. In a quasi-experimental study, Fortney and colleagues strongly supported the substitution effect of primary care using instrumental variable analyses (Fortney, Teffick, et al. 2005). Not only do the researchers control for endogeneity using an instrumental variable— travel distance to primary care— but they also used four calendar years of study period to capture the VA's natural experiment of increasing access to care by establishing new satellite primary care clinics. Their findings indicate that an increase in primary care is associated with a decrease in specialty care, but not associated with an increase in physical health admissions, or outpatient costs.

A number of studies on ambulatory care sensitive condition admissions provide a further theoretical framework for substitution effects between the use of outpatient and inpatient services. Ambulatory care sensitive conditions (ACSC) such as asthma, diabetes, and hypertension are conditions that are believed to be preventable in most cases at ambulatory care settings (Billings, Anderson, et al. 1996; Billings, Zeitel, et al. 1993). Bindman and his colleagues' (1995) established the link that ACSC admission rates could be used as an indicator of access to care (Bindman, Grumbach, et al. 1995). Higher rates of ACSC admissions are shown to be associated with worse health outcomes, low-income individuals, African Americans, and Medicaid beneficiaries (Gaskins and Hoffman 2000; Pappas, Hadden, et al. 1997; Weissman, Gatsonis, et al. 1992). The hypothesized link between better access to ambulatory care and low hospitalization rates provides intuitive sense that use of ACSC admissions in this study is appropriate as a measure for access to care among Medicaid beneficiaries and a proxy measure for health outcomes.

It is safe to say that lower ACSC admission rates can provide some evidence for assessing access to care, but may not always reflect better health outcomes. If the population using ambulatory care, for example, does not overlap with the population experiencing ACSC admissions, then increased use of ambulatory care does not necessarily decrease (or increase) ACSC admissions rates. Lower rates of ACSC admissions could reflect decreased access to inpatient care. When the use of ambulatory and inpatient services of the same individuals is compared, the lower ACSC admission rates that reflect decreased use of inappropriate health services would presumably lead to better health outcomes.

Empirical framework

Because the literature shows inconclusive findings, the question of whether increased access to ambulatory care through transportation brokerage services may lead to a decreased use of inpatient care becomes an empirical issue. The premise is that transportation brokerage services alter access to care (i.e., the availability of NEMT) and, in turn, affect use of other medical services. Identification of the full effects of transportation brokerage services comes from three sources of variation: time-series variation between pre and post periods, geographic variation within states, and cross-sectional variation across states.

Time-series variation refers to the differences between before and after the implementation of transportation brokerage services. The more room for improvements in the provision of transportation services in the pre-period will make larger pre-post differences. For example, if transportation services are less organized in a way to decrease beneficiaries' access to care, a change in the management of transportation services to improve reliability could lead to a big difference in the use and expenditures of NEMT services. In other words, transportation brokerage services would change the behaviors of some beneficiaries who are unaware of easier and inexpensive transportation services and may abuse ambulance or relatively expensive transportation alternatives. The effect also applies to any change in behaviors of transportation providers: an incentive to provide of services in rural regions should increase access to care in underserved areas.

Geographic variation helps identify differences between areas with plenty of transportation options and areas with fewer options. Previous geographical differences in the service provision and use within states would further produce some differences between before and after the implementation of transportation brokerage services. Cross-sectional variation refers to the different implementation timing of transportation brokerage services. At one point in time, there are counties with transportation brokerage services and without it. To this end, differences in implementation dates across states generate cross-sectional variations in the effect of transportation brokerage services, which help control of general trends.

Since Medicaid covers heterogeneous populations, access to care including NEMT would differ by urban/rural locations and beneficiaries' medical conditions. If beneficiaries with varying backgrounds have different access to and use of various medical services, they are likely to be affected differently by transportation brokerage services. Changes in the use and expenditures of various medical services by medical conditions are linked to any difference in the use of certain health services that reflect health outcomes. In summary, testable hypotheses stemming from this conceptual framework are described below:

H1: The direct effect of transportation brokerage services on the use and expenditures of transportation-related services will vary by group of beneficiaries

The direct effect of transportation brokerage services on medical transportation is examined in two components: non-emergency medical transportation and ambulance transport. Research suggests that transportation brokerage services, through efficient management of resources, would directly decrease unit cost per person per trip (Dai 2005; O'Connell, Grossardt, et al. 2002). While the unit cost per trip may decrease, the number of total trips may increase or decrease. For some beneficiaries in previously underserved areas, transportation brokerage services would increase access to transportation and medical care. The use of transportation-related services might decrease where abuse and fraud were a problem. Therefore, the direct effect of transportation brokerage services on transportation expenditures is ambiguous. It is expected that cost savings from a decreased unit cost per trip per person may outweigh the increased number of trips because capitation means that brokers have incentives to hold unit cost down. However, the use and expenditure of ambulance transport is hypothesized to decrease due to transportation brokerage services. Specific hypotheses are the following:

H1a: Non-emergency medical transportation expenditures will vary by groups of beneficiaries

H1b: Transportation brokerage services will decrease use and expenditures of ambulance transport

H2: The spill-over effects of transportation brokerage services on other Medicaid expenditures and uses will vary by type of Medicaid services

Provision of reliable transportation is expected to increase access to care for some beneficiaries. For example, outpatient care expenditures could increase if transportation brokerage services enable more asthma children to obtain preventive care. On the other end of the scale, increased preventive health care visits may lead to a decrease in the use of inpatient services and emergency room. Total health care expenditures will increase if the greater use of outpatient services outweighs cost savings from the lower use of inpatient services. Therefore, the spill-over effects of transportation brokerage services on medical services use and expenditures would not be uniform and potentially offsetting. Specific hypotheses are the following by types of medical services:

H2a: The shift to transportation brokerage services will increase total health care expenditures

H2b: The shift to transportation brokerage services will increase expenditures and use of outpatient services and prescription drugs

H2c: The shift to transportation brokerage services will decrease expenditures and use of inpatient services and emergency room services

H3: The spill-over effects of transportation brokerage services will vary by selected medical conditions

Medicaid covers heterogeneous populations in terms of medical conditions, gender, residential locations, and age groups. After the implementation of transportation brokerage services, beneficiaries with certain medical conditions may be better off in terms of access to care and health outcomes while beneficiaries with other conditions may not be better off. Those who are chronically ill, need frequent doctor visits, and reside in areas with limited transportation services would have different expenditures and use profiles from those with acute illness and/or reside in areas with plenty of transportation alternatives. Thus, this analysis considers possible different effects of transportation brokerage services on persons with two medical conditions: children with asthma and adults with type 2 diabetes. These groups of beneficiaries are analyzed not only because they have different use and expenditures profiles, but also they use both acute care and regular doctor visits.

H4: Transportation brokerage services will decrease use of certain health services

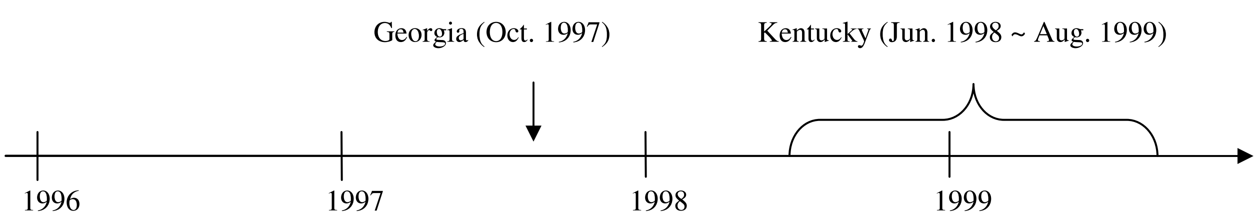
To comprehensively assess the effects of transportation brokerage services, the change in expenditures and use of Medicaid services are linked to beneficiaries' use of certain types of service that reflect worse access to care and health outcomes. Decreased expenditures, or use, are not necessarily good if access to care is decreased and health outcomes become worse. Health services use measures such as ACSC admissions and ER use can serve as proxies for beneficiaries' health outcomes and measures for access to care. When children with asthma have timely preventive and primary care visits, hospitalization due to severe asthma attack can be prevented. Patients with diabetes are less likely to face complications that require specialty care and hospitalization if patients are identified and treated effectively in primary care settings. Emergency room use for chronic medical conditions (e.g., asthma, diabetes) can represent both decreased access to appropriate care and poor health outcomes. Thus, the shift to transportation brokerage services is hypothesized to decrease ACSC admissions and ER use due to medical conditions. Lower rates of theses services use provide evidence that access to appropriate health services improved.

CHAPTER 3. RESEARCH DESIGN AND METHODS

Research Design

The study uses Medicaid data from two states: Georgia and Kentucky. These states were chosen for four reasons: 1) implementation of transportation brokerage services at different times; 2) similar payment for NEMT during the pre-period; 3) a similar percentage of NEMT spending to total Medicaid costs during the pre-period; and 4) the same type of NEMT payment in the post-period.

The study period, calendar year from 1996 to 1999, corresponds to the period of a natural experiment during which Georgia and Kentucky implemented transportation brokerage services. Georgia implemented transportation brokerage services in 1997 while Kentucky started from 1998. The diagram below illustrates the timing of the implementation of transportation brokerage services in Georgia and Kentucky. In 1997, about 1.5% of total Medicaid expenditures was spent on NEMT costs (Rafael 1997). During the pre-period, transportation providers were paid on a fee-for-service basis with little or no prior approval. Transportation brokers are reimbursed for capitated rates in the post-period.



With the natural experiment of transportation brokerage services in Georgia and Kentucky, I use a difference-in-differences model to assess the effect of transportation brokerage services on Medicaid beneficiaries' access to care. This approach is based on the principle that counties with transportation brokerage services should experience the effects of transportation brokerage services, while counties without transportation brokerage services should not. The design is strengthened by the staggered implementation dates between states and within a state. If counties shifted to transportation brokerage services earlier experience changes in access to care earlier than comparison states, then the changes are more likely to be due to transportation brokerage services than to general trends.

3.1. Methods to Analyze the Effects of Transportation Brokerage Services on Medicaid Expenditures

The first overall research question addressed in this study is the following: Have Medicaid expenditures, as measured by types of medical and transportation-related expenditures, been affected as a result of the transportation brokerage services? This general research question encompasses three hypotheses based on the conceptual model relating to access to care:

- The direct effect of transportation brokerage services on transportation-related expenditures and use will vary by group of beneficiaries
- The spill-over effects of transportation brokerage services on other Medicaid expenditures and use will vary by type of Medicaid services
- The spill-over effects will vary by selected medical conditions.

Estimation Procedure

The same estimation procedure was used with each type of expenditure. Expenditures are modeled as a function of transportation brokerage services, time trends, and individual-level characteristics separately for each type of expenditures. The basic model for individual *i* in a county *g* at time *t* has the following form:

$$\Pr[Expenditures > 0 \mid X] = \alpha + \beta\ TBS_{igt} + X_{it}\gamma + Year_t + Month_t + \varepsilon_{igt} \qquad (1)$$

$$E[Expenditures \mid Expenditures > 0, X] = \mu + \delta\ TBS_{igt} + X_{it}\lambda + Year_t + Month_t + \upsilon_{igt} \qquad (2)$$

where the β and δ are the key parameters of interest to estimate, the vector *X* represents beneficiaries' age categories, and α and μ represent individual fixed effects coefficients, *Month* represents month fixed effects to control for seasonal variations in service use, *YEAR* represents time trends, and ε and υ are error terms that is assumed to be independent of the explanatory variables. The variable *transportation brokerage service (TBS)* equals 1 if an individual lives in a county that does have transportation brokerage services and 0 otherwise.

The two-part model is appropriate when a large percentage of the sample is expected not to have any use. The model allows estimating separate effects for probability and extent of expenditures (Duan, Manning, et al. 1984). An ordinary least squares (OLS) linear probability model is used to estimate equation (1), which predicts the probability of any health care use; a logit estimation with more than 1 million individual observations fixed effects cannot converge in a reasonable amount of time. An OLS model with logged expenditures, so as to diminish the influence of outliers, is used to estimate equation (2), which predicts extent of logged expenditures, conditional on any use, on a subset of the sample. Because the continuous dependent variables are logged, smearing factors are calculated for retransformation to actual dollar interpretation (Duan 1983). The error terms (υ) assumed to be heteroskedastic and non-normal because different types of expenditures are analyzed. The smearing factor (*S*) is calculated using equation (3) to control for heteroskedasticity and non-normal errors. The smearing calculation is done once for each type of services with different N observations per service.

$$S = \left(\frac{1}{N} \sum_{i=1}^{N} \hat{\upsilon}_i \right) \tag{3}$$

A change in explanatory variables would affect dependent variables in two ways: the probability of any use and the amount of use conditional on some use. Thus, incremental effects in two-part models require additional computation. The following equation (4) is used to compute incremental effects of transportation brokerage services by types of Medicaid expenditures.

$$\frac{\partial E[y]}{\partial X_i} = \left(\Pr[y > 0] \times \frac{\partial E[y \mid y > 0]}{\partial X_i} \right) + \left(\frac{\partial \Pr[y > 0]}{\partial X_i} \times E[y \mid y > 0] \right) \tag{4}$$

Incremental effects are also estimated with the smearing factor and adjusting for heteroskedasticity (Ai and Norton 2000). In the first set of parentheses, the first term ($\Pr[y > 0]$) is the predicted probability from linear probability model. The second term $\left(\frac{\partial E[y \mid y > 0]}{\partial X_i} \right)$ is the difference between estimates with *TBS* equals to 1 and to 0, which estimated with smearing factor (S). The first term $\left(\frac{\partial \Pr[y>0]}{\partial X_i}\right)$, in the second set of parentheses, is β estimates from the first part linear probability models. The second term $\left(E[y \mid y>0]\right)$ refers to estimates from the second part of two-part models, which are also calculated with smearing factors.

To test the significance of incremental effects, standard errors are estimated using boot-strapping. The boot-strapping technique draws a number of observations randomly, with replacement, from a dataset. By 200 repetitive random drawing of samples in each type of expenditures, the models are re-estimated and produce new coefficients and new predicted values using equation (4) (i.e., incremental effects) from each drawing. With new incremental effects estimates, standard errors of incremental effects can be calculated and used to test statistical significance. If the estimated incremental effects in two-part models are negative and statistically significant, it would suggest a decrease in monthly expenditures and services use per person.

Variables in the Analysis

The dependent variables in the analysis are person-level monthly expenditures. Medicaid claims files provide individual-level data for each type of expenditure and service use. The eight types of Medicaid expenditures are total, outpatient, inpatient, pharmacy, emergency room, other, ambulance and non-emergency medical transportation expenditures. Each dependent variable was analyzed in a separate two-part model. Individual-level expenditures are based on paid claims and represent the actual amount reimbursed to the provider through Medicaid. The dollar amount of each claim is summed within each month to create up to 48 observations per person.

Transportation-related expenditures (i.e., ambulance and non-emergency medical transportation) are analyzed with observations for transportation users. For ambulance expenditures, only claims in Georgia are used because ambulance claims are not available in the Kentucky data. All expenditures were adjusted for inflation to December 1999, using the consumer price index for medical care (Bureau of Labor Statistics 2004).

The expenditures, except total expenditures, are classified as mutually exclusive. Total expenditures are the sum of expenditures except non-emergency medical transportation expenditures. Other expenditures are the sum of expenditures that are not included in other dependent variables. For emergency room and pharmacy expenditures, individual observations in Kentucky in the post-period are dropped from the analyses once counties are shifted to transportation brokerage services because Kentucky transportation brokerage services do not provide pharmacy trips and emergency room claims are not recorded separately from inpatient claims beginning from 1998.

The explanatory variable of primary interest is *transportation brokerage service*. Following a standard difference-in-differences specification, the *transportation brokerage service* represents the interaction term between time trend and treatment. It is the differential effect of interest. If effects on expenditures are greater for counties with transportation brokerage services than counties without transportation brokerage services, we can most likely attribute the effects to transportation brokerage services. Because of the potential for omitted individual-level factors and because correlation exists among observations over time, the models were estimated using individual fixed effects. Individual fixed effects also control for any time invariant personal characteristics (e.g., gender, race, underlying disease severity). Time fixed effects (3 indicators for year 1997-1999) were also included to account for any underlying time trends, not necessarily linear, that could be correlated with the *transportation brokerage service* implementation.

3.2. Methods to Analyze Effects of Transportation Brokerage Services on Use of Certain Health Services

The second research question addressed in this study is the following: Have transportation brokerage services affected beneficiaries' health services use? This general research question includes one hypothesis:

- Transportation brokerage services will decrease beneficiaries' certain health services use that indicates inappropriate health services use and decreased access to an appropriate site of care

Estimation Procedure

Like the expenditure models, uses of certain health services are modeled as a function of TBS, time trends, and individual-level characteristics. The measures of health services use include the use of emergency room due to specific medical conditions and the ACSC admissions. The basic models for individual *i* in a county *g* at time *t* has the following form:

$$\Pr[\text{Health Services Use}_{igt} \mid X] = \tau + \eta \, TBS_{igt} + X_{it}\varphi + YEAR_t + Month_t + \mu_{igt} \qquad (5)$$

where the η's are key parameters of interest to estimate, *Month* represents month fixed effects to control for seasonal variations in service use, *YEAR* represents time trends, and μ is the error term that is assumed to be independent of the explanatory variables. The vector X represents beneficiaries' age categories. A linear probability model is used to estimate equation (5), which predicts the probability of any health services use.

Variables in the Analysis

The dependent variables in the analysis are health services use measures. The four different health services use measures are the following: ambulatory care sensitive condition admission of asthma children, ambulatory care sensitive admission of diabetic adults, emergency room use due to asthma attack, and emergency room use due to diabetes. The health services use measures are binary variables equal to 1 if the individual had an admission or use in a month and 0 otherwise. The list of ambulatory care sensitive conditions is given in Appendix A.

The same set of explanatory variables in the expenditure models are used for the health services use models. The negative and significant coefficient of *transportation brokerage service* represents lower use of emergency room due to specific medical conditions and lower ACSC admission. In other words, for theses four services, lower health services use mean an apparent decrease in inappropriate use of emergency department and inpatient admissions.

CHAPTER 4. DATA

The study was conducted using Medicaid data from two states, Georgia and Kentucky, from calendar year 1996 to 1999. Figure 4.1 describes Medicaid enrollment trends during the study period. Both states maintained relatively stable yearly enrollment, suggesting no abrupt eligibility criteria changes. On average, Georgia had about 1.2 million Medicaid beneficiaries and Kentucky had about 680,000 beneficiaries. The total number of unique Medicaid beneficiaries was 2,063,825 in Georgia and 1,038,433 in Kentucky. The study sample includes all Medicaid beneficiaries under age 65 in both states. To perform individual-level-analysis, both claims and eligibility files are used. The claims files include information about medical expenditures, provider characteristics, Diagnosis Related Group codes, and dates of service incurred. The eligibility files include beneficiaries' demographic information and eligibility status of each month, which allows us to distinguish months of zero use from months of non-eligibility. By including all claims of the same person in the analysis, I will estimate the changes in expenditures by type of services.

While Georgia implemented statewide transportation brokerage services on October 1997, Kentucky started a pilot program in five counties from June 1998 (Wilson, Nutt, et al. 2000). Georgia has 159 counties and Kentucky has 120. In Kentucky, fifty three counties in 1998 and sixty seven counties in 1999 implemented transportation brokerage services (Hager, Hewlett, et al. 2004). Figure 4.2 shows the number of counties by implementation dates. The differences in implementation dates between states and within a state allow each state to serve as a control to each other. Counties with Primary Care Case Management Program (PCCM) are included in the study because all medical services are reimbursed on fee-for-service basis in addition to a $3 per person per month PCCM fee.

Three study populations are identified: transportation users, children with asthma, and adults with type 2 diabetes. With the well-defined populations, benefits from transportation brokerage services can be distinguished. I took random samples of about 40% from each study population to minimize computational processing time of boot-strapped estimates. I then restricted the study samples to beneficiaries who were eligible at least one month in both pre- and post-periods to reduce issues of selection. Children under state children health insurance program are excluded because they are not eligible for transportation brokerage services.

Counties with a full-risk capitated health maintenance organization (HMO) are also excluded from the study sample because of a selection issue and no encounter data in Medicaid claims files. When Medicaid beneficiaries can choose to enroll in a voluntary HMO, beneficiaries with good health status or those who need less health care services are more likely to enroll. Then, those who stay left in fee-for-service settings may not have representative profiles of use and expenditures. The names of counties with full-risk HMOs can be found in Table 4.1. From the total of 279 counties in Georgia and Kentucky, 43 with HMOs, about 15% of the counties, are excluded from the study. Thus, the study sample includes a total of 236 counties.

At one time, three voluntary HMO programs covered four metropolitan statistical areas in Georgia, which are Atlanta, Augusta, Macon, and Savannah. As of December 1999, all contracts with voluntary HMOs were terminated—one of HMOs went out of business; the other had financial problems and pulled out totally in fall 1998; and the last one was shut down in 1999 (CMS 2004). Figure 4.3 shows six counties with HMOs in Georgia during the study period. Kentucky has had a fully capitated mandatory program in two urban regions since November 1997 (CMS 2004). The two urban regions include 16 counties in the Louisville area and 21 counties in the Lexington area: figure 4.4 shows thirty-seven counties with HMOs in Kentucky.

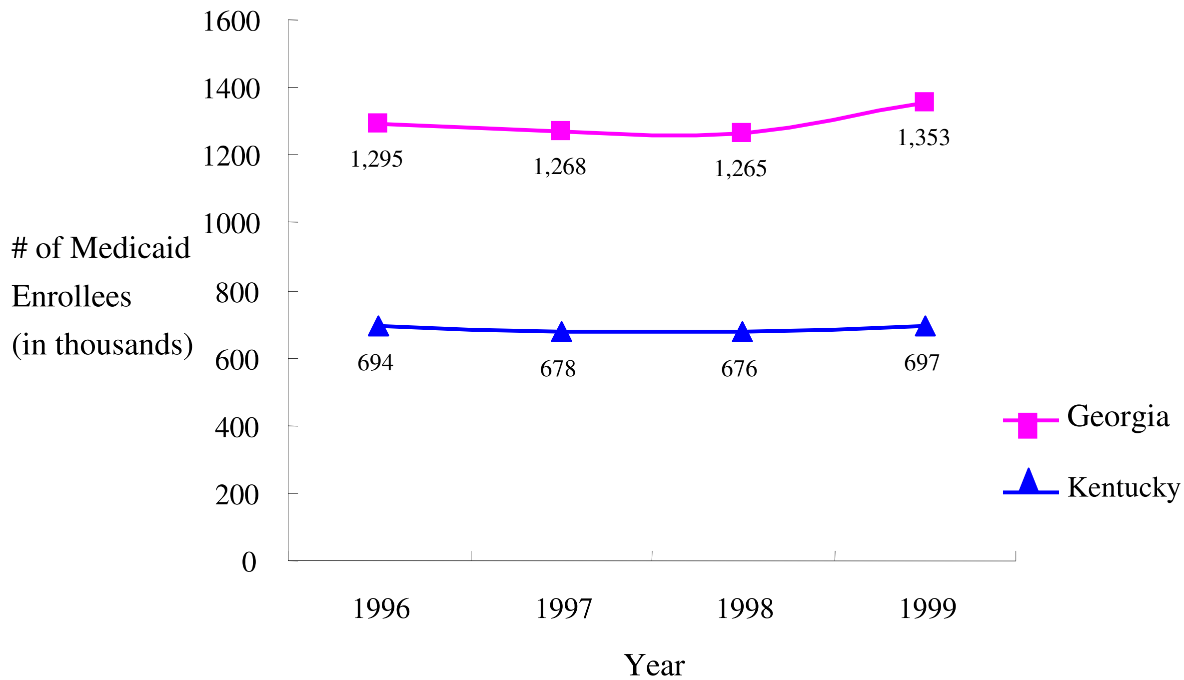
To examine the direct effects of transportation brokerage services on transportation-related expenditures, transportation users are identified as beneficiaries with any transportation use. During the study period, the total number of unique transportation users was 339,259 in Georgia and 241,103 in Kentucky. Figure 4.5 shows the NEMT users trends during the study period. In Georgia, the percentage of all NEMT users over total Medicaid beneficiaries decreased from 16% in 1996 to 5% in 1999. The percentage of NEMT users in Kentucky increased from 10% in 1996 to 20% in 1998 and then decreased 8% in 1999. The random sample of transportation users includes 54,421 users in Georgia and 42,743 users in Kentucky. The final study sample has 3,542,235 observations on 97,164 users at the person-month level. A description of particular variables used in the analyses is in Table 4.2. Across transportation user samples in both states, the average monthly NEMT expenditure per person was about $12 while the average ambulance expenditure was about $5. If a beneficiary had any use during a month, the average expenditure was about $160 for NEMT services and $185 for ambulance transport. About forty percent of the individuals in the sample are children (i.e. under age 19). The sample with race information is 47% male and 32% Black.

The spill-over effects of transportation brokerage services on other Medicaid expenditures are assessed with two different groups, each with a specific medical condition. The groups are identified using ICD-9 codes, National Drug Codes, and eligibility type codes. For identifying children with asthma, eligibility requirements include children aged 0 to 18 years who had (1) any health care use during the study years with a diagnosis of asthma (*International Classification of Diseases, Ninth Revision [ICD-9]* 493.XX) and (2) prescribed asthma medication. The medication list for asthma is given in Appendix B. The asthma children sample includes random samples of 22,327 children in Georgia and 14,385 children in Kentucky. The final sample has 1,139,803 observations on 36,712 children at the person-month level. For children with asthma, the average total health care expenditure per child per month was $122 and about 51% of the sample did not have any health care expenditure in a month (see Table 4.3). The monthly average outpatient expenditure is $76 and 56% of the sample did not have any outpatient expenditures in a given month. The sample with race information is 51% male, 27% Black and 2% Hispanic. Inpatient admissions with any of ICD-9 codes for ambulatory care sensitive conditions as the primary reason are considered as ambulatory care sensitive condition admissions. About 0.3% of the sample had an ACSC admission in a month. Emergency room use due to asthma per month was less than 0.1%.

Eligibility requirements for adult with diabetes include adults aged 19 to 64 years who had (1) any health care use during the study years with a diagnosis of type 2 diabetes (ICD-9 codes 250.XX) and (2) prescribed diabetes medication. The medication list for diabetes is given in Appendix B. The adult sample includes a random sample of 12,884 adults with types 2 diabetes in Georgia and 5,452 adults in Kentucky. The final study sample has

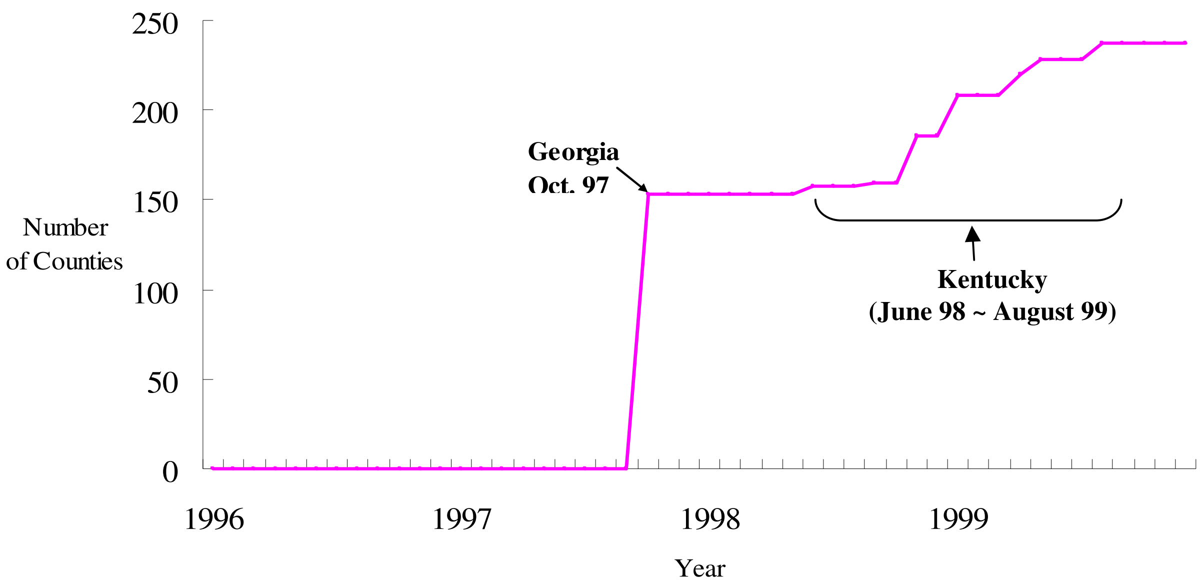
687,858 observations on 18,336 adults at the person-month level. About 13% (=2,319 adults) are disabled dually-eligible persons and about 4.5% (=828 adults) have used nursing homes during the study period. Adults with diabetes showed higher monthly expenditures and worse health status than children. The average total health care expenditure per person per month was $434 and 35% did not have any health care expenditures (see Table 4.4). The monthly average outpatient expenditure is $217 and 46% of the sample did not have any outpatient expenditures in a given month. The average age is 47, and ranges from 19 to 64. The study sample with race information is 38% male, 35% Black, and 1% Hispanic. Monthly ACSC admissions and emergency room use due to diabetes per person were 0.5% and 0.2%, respectively.

Figure 4.1 Medicaid Enrollment Trends: 1996 – 1999



Source: Georgia and Kentucky Medicaid Enrollment and Claims Data, CY 1996 to 1999.

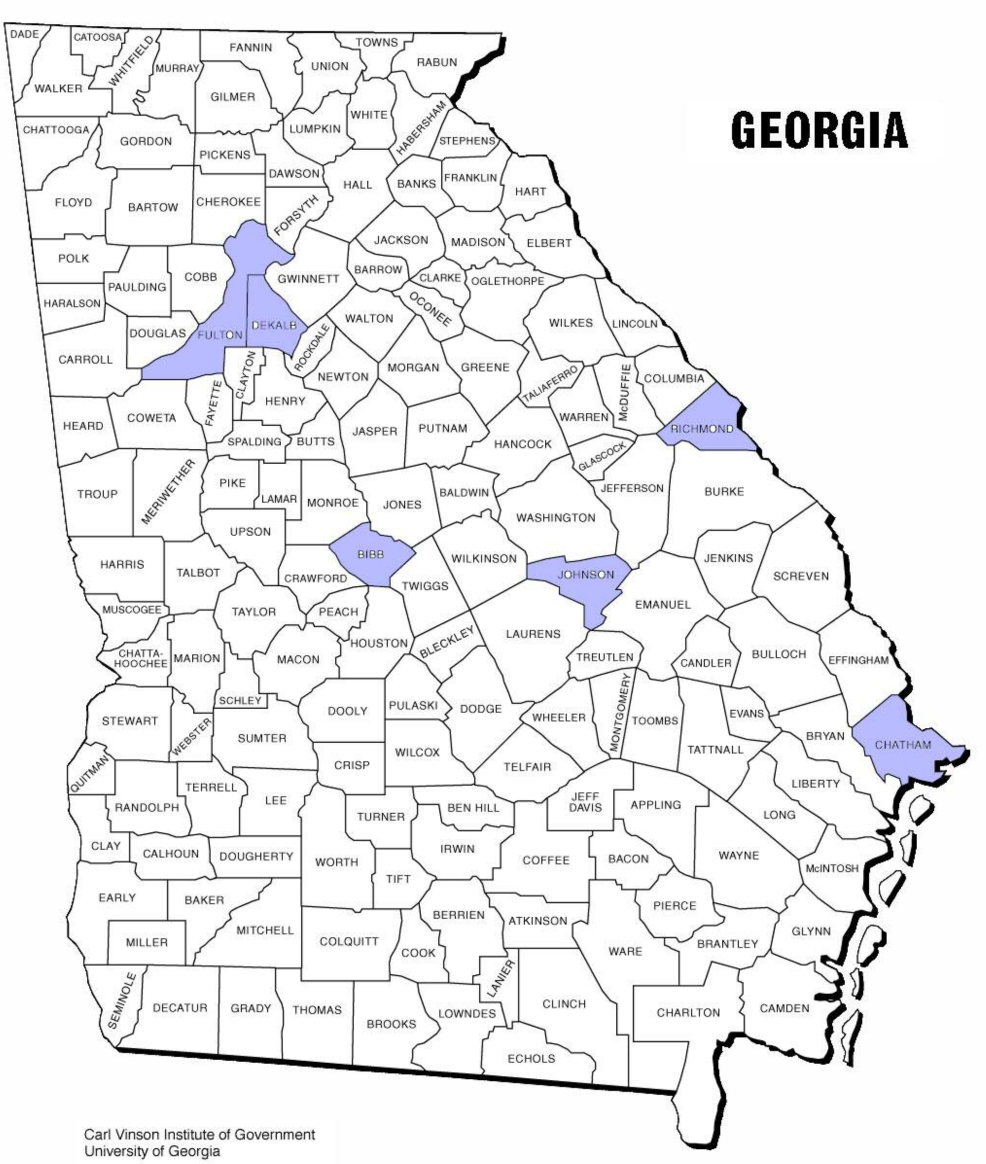
Figure 4.2 Transportation Brokerage Services Implementation Dates by Counties



Note: There are a total of 279 counties in Georgia and Kentucky. The study sample includes 239 counties in two states, excluding counties with HMOs.

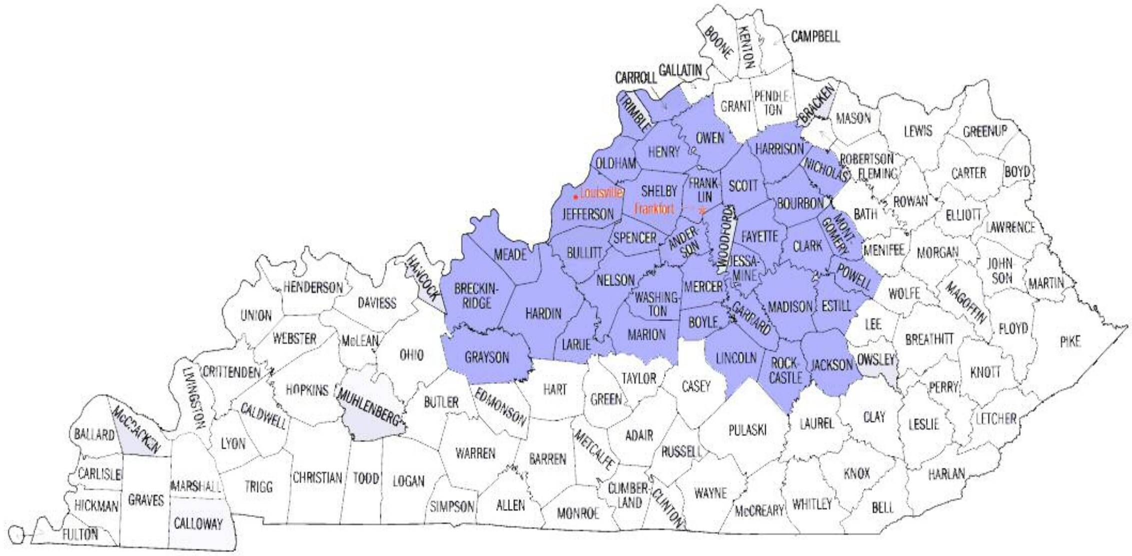
Source: CMS, Medicaid Program Statistics, Medicaid Statistical Information System

Figure 4.3 Counties with HMOs in Georgia



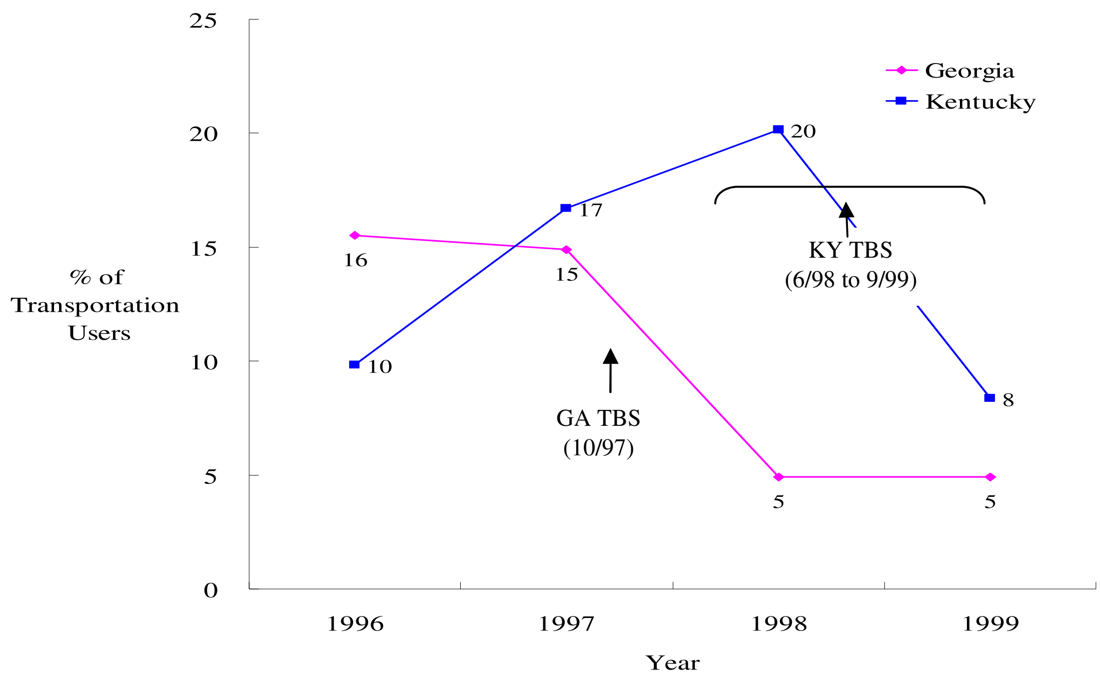
Note: Shaded areas represent counties with HMOs

Figure 4.4 Counties with HMOs in Kentucky



Note: Shaded counties represent counties with HMOs

Figure 4.5 Non-Emergency Medical Transportation Users Trends: 1996 – 1999



Note: Percentage of transportation users are calculated with all users over total Medicaid beneficiaries.

Table 4.1 Transportation Brokerage Services Implementation Dates by Counties

Implementation Dates	Number of Counties: Total (279 counties)	Study sample (236 counties)	With HMO (43 counties)	Name of Counties with HMO
GEORGIA				
October 1997	159	153	6	Dekalb, Fulton, Bibb, Johnson, Chatham, Richmond
KENTUCKY				
June 1998	5	5	0	
August 1998	28	17	11	Anderson, Boyle, Franklin, Garrard, Jessamine, Lincoln, Mercer, Scott, Washington, Woodford, Rockcastle
September 1998	9	0	9	Fayette, Bourbon, Clark, Estill, Harrison, Madison, Montgomery, Nicholas, Powell
November 1998	11	10	1	Jackson
January 1999	24	22	2	Carroll, Owen
April 1999	12	12	0	
May 1999	8	8	0	
June 1999	6	0	6	Bullitt, Henry, Oldham, Shelby, Spencer, Trimble
July 1999	7	0	7	Breckinridge, Grayson, Hardin, Larue, Marion, Meade, Nelson
August 1999	9	9	0	
October 1999	1	0	1	Jefferson

Sources: CMS, Medicaid managed care enrollment report: 1996-1999. http://www.cms.hhs.gov/MedicaidDataSourcesGenInfo/04_MdManCrEnrllRep.asp; Hager, Greg., T. Hewlett, L. Atchley, and S. Otto. 2004. "Human service transportation delivery: system faces quality, coordination, and utilization challenges." *Research Report No. 319*: Fankfort, Kentucky.

Table 4.2 Summary Statistics for Transportation Users

Variable	Mean	Std. Dev.
Dependent Variables:		
NEMT Expenditures	$11.52	329.21
Pr(NEMT Expenditures>0)	.09	.29
NEMT Expenditures, if positive	$124.35	1,075.14
Ambulance Expenditures	$4.54	46.18
Pr(Ambulance Expenditures>0)	.02	.15
Ambulance Expenditures, if positive	$185.02	231.19
Policy/Time Trend Variables:		
TBS	.42	
1996	.26	
1997	.24	
1998	.24	
1999	.26	
Individual Characteristics;		
Male	.47	.50
Race		
Black	.32	.47
Hispanic	.007	.08
Other	.002	.04
Age		
Children (age<19)	.41	.49
Adults (18<age<65)	.59	.49

Note: *N* = 3,542,235 observations at the person month level on 97,164 unique persons. In Georgia, the total number of observations is 1,848,544 at the person month level on 54,421 unique persons. In Kentucky, the total number of observations is 1,693,691 at the person month level on 42,743 unique persons.

Table 4.3 Summary Statistics for Children with Asthma

Variable	Mean	Std. Dev.
<u>*Dependent Variables:*</u>		
Health Care Expenditures		
Total Expenditures	$121.78	687.69
Pr(Total Expenditures>0)	.49	.49
Total Expenditures, if positive	$248.14	965.54
Inpatient Expenditures	$23.86	557.84
Pr(Inpatient Expenditures>0)	.01	.11
Inpatient Expenditures, if positive	$2,051.58	4,754.15
Outpatient Expenditures	$75.82	608.41
Pr(Outpatient Expenditures>0)	.44	.49
Outpatient Expenditures, if positive	$174.32	913.19
Other Expenditures	$26.15	254.26
Pr(Other Expenditures>0)	.20	.39
Other Expenditures, if positive	$132.68	560.26
Prescription Drug Expenditures	$22.37	91.59
Pr(Prescription Drug Expenditures>0)	.24	.43
Prescription Drug Expenditures, if positive	$91.59	257.40
Emergency Room Expenditures	$2.21	56.72
Pr(Emergency Room Expenditures>0)	.04	.19
Emergency Room Expenditures, if positive	$56.72	47.42
Transportation-related Expenditures		
NEMT expenditures	$2.01	43.08
Pr(NEMT Expenditures>0)	.03	.16
NEMT Expenditures, if positive	$78.98	258.55
Ambulance Expenditures	$0.58	32.14
Pr(Ambulance Expenditures>0)	.002	.045
Ambulance Expenditures, if positive	$287.55	655.85
Health Services Use		
ACSC Admissions	.003	.053
Emergency Room Use due to Asthma	.0007	.027
<u>*Policy/Time Trend Variable:*</u>		

TBS	.41	
1996	.26	
1997	.24	
1998	.25	
1999	.24	
Individual Characteristics:		
Age, *yr*	5.48	4.48
Male	.51	.49
Black	.27	.44
Hispanic	.02	.14

Note: N = 1,139,803 observations at the person month level on 36,712 unique children.

Table 4.4 Summary Statistics for Adults with Diabetes

Variable	Mean	Std. Dev.
<u>*Dependent Variables:*</u>		
Health Care Expenditures		
Total Expenditures	$434.03	1,410.42
Pr(Total Expenditures>0)	.65	.48
Total Expenditures, if positive	$663.49	1,699.63
Inpatient Expenditures	$131.55	1,144.41
Pr(Inpatient Expenditures>0)	.05	.22
Inpatient Expenditures, if positive	$2,673.12	4,451.89
Outpatient Expenditures	$216.84	1,142.09
Pr(Outpatient Expenditures>0)	.54	.49
Outpatient Expenditures, if positive	$404.19	1,534.82
Other Expenditures	$61.24	315.55
Pr(Other Expenditures>0)	.25	.43
Other Expenditures, if positive	$242.95	592.35
Prescription Drug Expenditures	$110.54	298.60
Pr(Prescription Drug Expenditures>0)	.50	.49
Prescription Drug Expenditures, if positive	$222.94	393.41
Emergency Room Expenditures	$3.45	28.47
Pr(Emergency Room Expenditures>0)	.04	.20
Emergency Room Expenditures, if positive	$79.52	112.33
Transportation-related Expenditures		
NEMT expenditures	$9.68	79.56
Pr(NEMT Expenditures>0)	.06	.23
NEMT Expenditures, if positive	$165.49	287.04
Ambulance Expenditures	$3.05	38.26
Pr(Ambulance Expenditures>0)	.02	.12
Ambulance Expenditures, if positive	$196.62	237.54
Health Services Use		
ACSC Admissions	.005	.068
Emergency Room Use due to Diabetes	.002	.039
<u>*Policy/Time Trend Variables:*</u>		
TBS	.44	

1996	.28	
1997	.24	
1998	.24	
1999	.23	
Individual Characteristics:		
Age, *yr*	46.92	11.84
Male	.38	.48
Black	.35	.48
Hispanic	.01	.08

Note: N = 687,858 observations at the person month level on 18,336 unique persons.

CHAPTER 5. RESULTS

5a. Effects of Transportation Brokerage Services on Transportation Expenditures

Transportation brokerage services have significant effects on the likelihood of use and expenditures of transportation services. Figure 5.1 shows NEMT expenditures trends over the study period. The change in NEMT expenditures is bigger in Georgia than in Kentucky. The mean monthly expenditures per person in Georgia decreased substantially from $16 in 1996 to $4 in 1999, while the monthly expenditures with any use gradually increased from $118 to $189. The Kentucky monthly expenditures per person increased from $10 in 1996 to $17 in 1998, but decreased to $9 in 1999. The monthly expenditures with any use decreased from $135 to $76 in 1998, but rose again to $241 in 1999. Figure 5.2 shows the comparison of mean expenditures between pre- and post-periods and confirms that transportation brokerage services substantially decreased NEMT expenditures in Georgia. However, if an individual had any use, the monthly mean expenditures per person increased. Kentucky also had a decrease between pre-and post-periods, and, if an individual had any use, the monthly mean expenditures per person also decreased substantially.

H1a: Non-emergency medical transportation expenditures will vary by groups of beneficiaries

Results confirm the hypothesis: NEMT expenditures decreased among transportation users and adults with diabetes while NEMT expenditures increased among children with asthma. The results for the two-part models on NEMT expenditures are listed in Table 5.1. The results suggest that transportation users and adults with diabetes might have overused NEMT services prior to transportation brokerage services while children with asthma might have underused.

For the transportation user sample, the probability of any non-emergency medical transportation use in a month decreased by 0.3 percentage points (from a mean of 9.4 percent in the pre-period) after the implementation of transportation brokerage services, and expenditures per month (conditional on any NEMT use) fell by 68 percent ($-.682 = \exp(-1.147)-1$). The incremental effect is a decrease in monthly per person expenditures of about $6 in December 1999 dollars. Adults with diabetes also showed the trend of decrease in the use and expenditures of NEMT services. For adults with diabetes, the probability of any use decreased by 3.7 percentage points (from a mean of 7.5 percent in the pre-period) and monthly expenditures (conditional on any transportation use) fell by 51 percent. The incremental effect is a decrease in monthly NEMT expenditures per person of $12.

On the other hand, for children with asthma, the probability of any transportation use increased by 5.6 percentage points, but expenditures per month (conditional on any transportation use) fell by 87 percent. The incremental effect is an increase in monthly NEMT expenditures per person of about $10. All coefficients are highly statistically significant.

H1b: Transportation brokerage services will decrease ambulance use and expenditures

Using only Georgia data, the results support the hypothesis that transportation brokerage services decreased ambulance use. For transportation users, the probability of any ambulance in a month decreased 0.8 percentage points (from a mean of 2.8 percent in the pre-period), and expenditures per month (conditional on any ambulance use) fell by 2.8 percent. The probability of any ambulance use in month among children with asthma decreased 0.2 percentage points (from a mean of 0.3 percent in the pre-period). The decreased probability of ambulance use among adults with diabetes was not statistically significant, but expenditures per month decreased by 19 percent. The incremental effects for all study samples are minimal decreases, which suggest that the effect of transportation brokerage services on ambulance expenditures were not significant.

5b. Effects of Transportation Brokerage Services on Medicaid Expenditures

The results confirm the two hypotheses that the effects of transportation services will vary by medical conditions and by type of Medicaid services. By medical conditions, different direction and magnitude of the spill-over effects on medical services are presented.

<u>Children with Asthma</u>

Transportation brokerage services have significant effects on the likelihood of any health care use and Medicaid expenditures. Results from the two-part models on the six selected categories expenditures for asthma children are listed in Table 5.2. Although the probability of any use was different by type of services, monthly expenditures per person (conditional on any use) of total, inpatient, and outpatient services decreased significantly. Results from children with asthma conform to expectations that the effects of transportation services would vary by type of medical services.

H2a: The shift to transportation brokerage services will increase total health care expenditures

For the asthma children sample, the probability of any health care use in a month increased by 5 percentage points after the implementation of transportation brokerage services, while expenditures per month (conditional on any health care use) fell by around 19 percent ($-.189 = 1 - \exp(-.2098)$). Both coefficients are highly statistically significant. The incremental effect is a decrease in monthly per person expenditures of $18 (compared to the mean expenditure of $135 in the pre-period). It is statistically significant and translates into a 13% (.13 = 18/135) decrease in monthly health care expenditures per person. The hypothesis that total health care expenditures will increase is not confirmed: the decrease in expenditures per month conditional on any use outweighed the increase in the probability of using any health care services.

H2b: The shift to transportation brokerage services will increase expenditures and use of outpatient services and prescription drugs

The results partly confirmed the hypothesis: an increase in the use of outpatient services. The probability and expenditures of prescription drug use decreased, but, were minimal and not statistically significant.

The probability of any outpatient care is increased by 5 percentage points, while outpatient monthly expenditures per person (conditional on any outpatient care use) decreased by around 20 percent. The full incremental effect is a decrease in outpatient monthly expenditures of $16 per person (compared to the mean expenditure of $83). The probability of any other services increased by 12.5 percentage points, while monthly other expenditures per person decreased by 33 percent. The full incremental effect is an increase in monthly outpatient expenditures of $4 per person (compared to the mean expenditure of $32). All coefficients are highly statistically significant.

H2c: The shift to transportation brokerage services would decrease expenditures and use of inpatient services and emergency room

Results support that transportation brokerage services decrease use and expenditures of inpatient services. The probability of any inpatient care is decreased by 0.5 percentage points (from a mean of 1.2 percent), and inpatient monthly expenditures per person decreased by around 9 percent. The incremental effect is a decrease in monthly inpatient expenditures of $4 per person, and is statistically significant. The probability of emergency room use is decreased by 0.3 percentage points (from a mean of 0.4 percent). However, the coefficients are not statistically significant, and incremental effects are minimal.

Adults with Diabetes

For adults with diabetes, transportation brokerage services have positive effects on the likelihood of having any health care. Results from the two-part models on the six selected expenditures are listed in Table 5.3. All types of monthly expenditures per person (conditional on any use) decreased, while the probability of using health care services, which include outpatient, other, and prescription drug services, increased. The results for adults with diabetes also conform to the expectation that the effects vary by type of services.

H2a: The shift to transportation brokerage services will increase total health care expenditures

For the sample of diabetic adults, the probability of any health care use in a month increased by 1.1 percentage points after the implementation of transportation brokerage services, while expenditures per month (conditional on any health care use) fell by around 7 percent. The incremental effect is a decrease in monthly per person expenditures of about $18 (compared to the mean expenditure of $412 in the pre-period). All coefficients are highly statistically significant. The $18 decrease translates into a 4.4% (.044 = 18/412) decrease in monthly per person expenditures. The result does not confirm the hypothesis that total health care expenditures will increase. As with the result for children with asthma, the decreased expenditures per month conditional on any use seem to outweigh the increased probability of using health care services.

H2b: The shift to transportation brokerage services will increase expenditures and use of outpatient services and prescription drugs

The results confirm the hypothesis that the use of outpatient services and prescription drug will increase. The probability of any outpatient care use is increased by 4.8 percentage points, and monthly outpatient expenditures per person fell by 15 percent. The incremental effect is an increase in monthly expenditures per person of about $9 (compared to the mean expenditure of $187). All coefficients are highly statistically significant. The probability of any prescription drug use is increased by 0.8 percentage points, while monthly prescription drug expenditures per person decreased 2 percent. Only the coefficient of probability is statistically significant.

The probability of any other services is increased by 7.1 percentage points, while monthly other expenditures per person decreased by 34 percent. Both coefficients are statistically significant, but the incremental effect is minimal.

H2c: The shift to transportation brokerage services would decrease expenditures and use of inpatient services and emergency room

The results do not strongly support that the shift to transportation brokerage services will decrease the use of inpatient and emergency room among adults with diabetes. The probability of any inpatient care use increased by 0.2 percentage points (from mean of 5 percent), while expenditures per month decreased by around 14 percent. The incremental effect is a decrease in monthly inpatient expenditures per person of about $9, but not statistically significant. The probability of emergency room use is decreased by 0.2 percentage points (from mean of 0.4 percent), but is not statistically significant.

5c. Effects of Transportation Brokerage Services on Use of Certain Health Services

Transportation brokerage services decreased use of certain health services use among adults with diabetes, while the effect is not statistically significant among children with asthma. Results for the health services use are listed in Table 5.3.

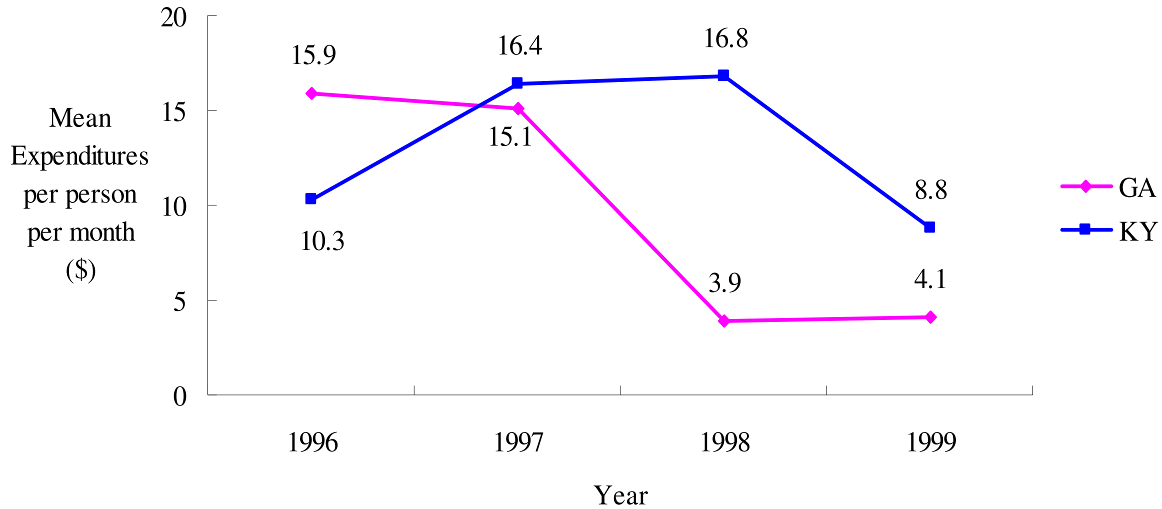
H4: Transportation brokerage services will decrease ACSC admissions and ER use due to medical conditions

For children with asthma, the probability of having an ACSC admission in a month increased by 0.03 percentage points from a mean of 0.27 percent. The probability of any emergency room use due to asthma decreased by 0.03 percentage points from a mean of 0.09 percent. Both coefficients were not statistically significant.

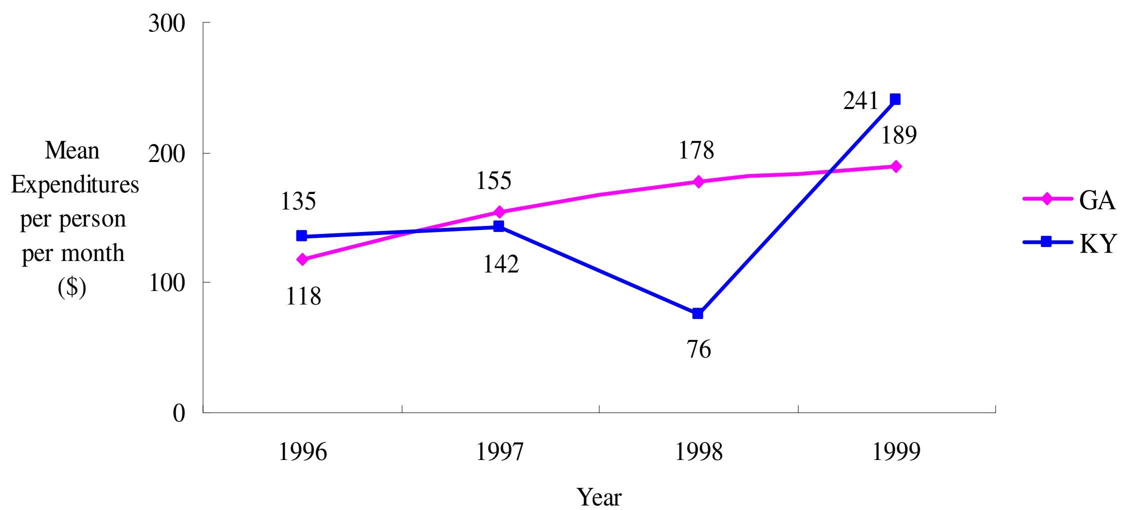
For adults with diabetes, the probability of having an ACSC admission in a month decreased by 0.1 percentage points from a mean of 0.5 percent. The probability of any emergency room use due to diabetes decreased by 0.06 percentage points from a mean of 0.19 percent. The coefficient of ACSC admissions is statistically significant. The negative coefficients mean that there is less likelihood of inappropriate use of health services. The hypothesis was partly supported only among adults with diabetes.

Figure 5.1 Non-Emergency Medical Transportation Expenditures Trends: 1996 – 1999

a. All observations



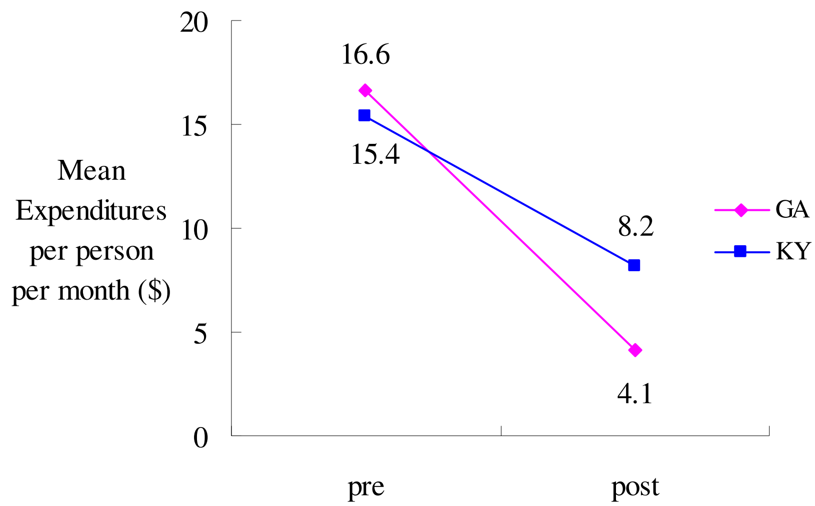
b. With only positive expenditures



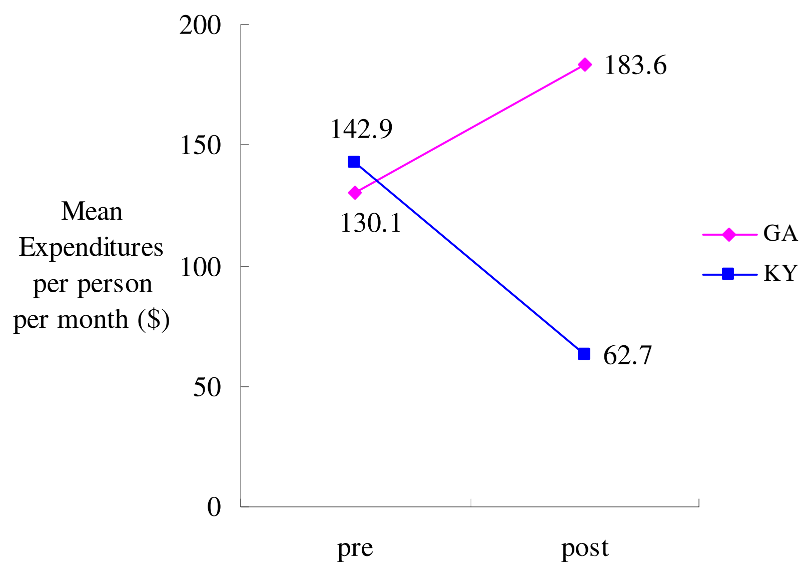
Note: *N*=97,164 unique individuals: 54,421 persons in Georgia and 42,743 persons in Kentucky.

Figure 5.2 Comparisons of Pre- and Post-period Non-Emergency Medical Transportation Expenditures

a. All observations



b. With only positive expenditures



Note: Pre-period is defined before the implementation, and post-period is after the implementation of transportation brokerage services.

Table 5.1 Results for Transportation Expenditures

	Likelihood of Use	*Level of Use conditional on some use*	*Incremental effect*
Transportation Users			
NEMT	$-.00278^{***}$ (.00069)	-1.147^{***} (.010)	-6.05^{***} (.62)
Ambulance	$-.0081^{***}$ (.0015)	−.024 (.051)	−1.21 (2.92)
Children with Asthma			
NEMT	$.05551^{***}$ (.00068)	-2.022^{***} (.032)	9.71^{***} (1.15)
Ambulance	$-.00196^{***}$ (.00064)	−.25 (.27)	−.73 (4.41)
Adults with Diabetes			
NEMT	$-.0365^{***}$ (.0012)	$-.711^{***}$ (.029)	-11.74^{***} (1.14)
Ambulance	−.0022 (.0014)	$-.21^{**}$ (.11)	−1.15 (6.69)

*** Significant at .001; ** Significant at .05

Note:

1. All models control for person fixed effects, year fixed effects, and month dummy variables.

2. *Transportation Users*: The total number of observation is 3,542,235 at the person month level on 97,164 unique persons. For ambulance transport, only Georgia data are used: the total number of observation is 1,659,305 at the person month level on 54,421 unique persons.

Table 5.2 Results for Health Care Expenditures: Children with Asthma

	Likelihood of Use	*Level of Use conditional on some use*	*Incremental effect*
<u>*Children with Asthma*</u>			
Total	.0486*** (.0019)	−.2098*** (.0080)	−17.80*** (1.24)
Inpatient	−.00479*** (.00048)	−.09 (.12)	−3.78** (1.77)
Emergency Room	−.0027 (.0017)	−.029 (.037)	−.20 (.43)
Outpatient	.0504*** (.0019)	−.2194*** (.0098)	−16.41*** (3.03)
Other	.1251*** (.0015)	−.402*** (.013)	3.80*** (.98)
Prescription Drug	−.0019 (.0034)	−.014 (.019)	−.35 (.69)

*** Significant at .001; ** Significant at .05

Note:

1. All models control for person fixed effects, year fixed effects, and month dummy variables.

2. *Children with Asthma*: For total, inpatient, outpatient, and other expenditures, the total number of observation is 1,139,803 at the person month level on 36,712 unique persons. For prescription drug and emergency room expenditures the total number of observation is 634,434 at the person month level on 22,327 observations. Incremental effects of expenditure variables are in dollar amount and calculated based on the sample of 800,000 observations.

Table 5.3 Results for Health Care Expenditures: Adults with Diabetes

	Likelihood of Use	*Level of Use conditional on some use*	*Incremental effect*
<u>*Adults with Diabetes*</u>			
Total	.0108*** (.0019)	−.0731*** (.0078)	−17.79*** (2.47)
Inpatient	.0019 (.0012)	−.152*** (.048)	−8.86 (24.94)
Emergency Room	−.0016 (.0019)	.044 (.043)	.03 (.56)
Outpatient	.0477*** (.0023)	−.159*** (.013)	−8.62*** (3.39)
Other	.0711*** (.0019)	−.413** (.014)	−.31 (1.28)
Prescription Drug	.0076** (.0033)	−.016 (.012)	−.08 (2.23)

*** Significant at .001; ** Significant at .05

Note:

1. All models control for person fixed effects, year fixed effects, and month dummy variables.

2. *Adults with Diabetes*: For total, inpatient, outpatient, and other expenditures, the total number of observation is 687,858 at the person month level on 18,336 unique persons. For prescription drug and emergency room expenditures, the total number of observation is 477,002 at the person month level on 12,884 observations. Incremental effects of expenditure variables are in dollar amount and calculated based on the sample of 480,000 observations.

Table 5.4 Results for ACSC Admission and ER Use

	Children with Asthma	*Adults with Diabetes*
ACSC admissions	.00035 (.00021)	−.00107** (.00033)
ER use due to medical conditions	−.00038 (.00020)	−.00058 (.00033)

** Significant at .05

Note:

1. All models control for person fixed effects, year fixed effects, and month dummy variables.

2. *Children with Asthma*: For ACSC admissions, the total number of observation is 1,139,803 at the person month level on 26,712 unique persons. For emergency room use due to asthma, the total number of observation is 634,434 at the person month level on 22,327 observations.

3. *Adults with diabetes*: For ACSC admissions, the total number of observation is 687,858 at the person month level on 18,336 unique persons. For emergency room use due to diabetes, the total number of observation is 477,002 at the person month level on 12,884 observations.

CHAPTER 6. DISCUSSION

The shift to transportation brokerage services has significant effects on Medicaid beneficiaries' access to care, as measured by different types of Medicaid expenditures and certain health services use. This study also finds different effects of transportation brokerage services for two different medical conditions.

The first hypothesis in this analysis—that the direct effect of transportation brokerage services on transportation-related expenditures will vary by group of beneficiaries—is supported. The magnitudes of the effects among transportation users and adults with diabetes are negative and statistically significant. There are two plausible explanations for decreased monthly NEMT expenditures per person among transportation users and adults with diabetes. One is that capitated reimbursement under brokerage services substantially decreases the trip cost per person, which would lead to a reduction in fraud and abuse of the system. The finding of decreased monthly NEMT expenditures per person is consistent with Dai's (2005) findings with Florida Medicaid data, which shows strong associations between significant decreased unit cost per trip and reductions in fraud and abuse in NEMT services. The other is that decreased cost per trip might induce brokers to withhold transportation services, which could lead to decreased likelihood of using NEMT services and medical services. If the latter explanation is true, the access to care should decrease (i.e., decreased likelihood of using medical services among those who used less NEMT services).

The results for children with asthma, on the contrary, show an increase in the monthly per person NEMT expenditure. One plausible explanation is that transportation brokerage services actually increased access to NEMT services for this study population; therefore, the increased likelihood of access to NEMT services outweighs decreased cost per person per trip. Another explanation is that children with asthma could have underused NEMT services prior to brokerage services. When increased use of NEMT services among children with asthma can represent better access to medical care, the increased monthly NEMT expenditures per person is good.

The beneficiaries' satisfaction with brokerage services should be addressed with the changes in the likelihood and expenditures of NEMT services. A survey of satisfaction of transportation users indicates that brokerage services provide reliable and satisfactory NEMT services to Medicaid beneficiaries. The progress report on transportation brokerage services in Kentucky indicated that 78% of satisfaction survey respondents were satisfied or very satisfied with the NEMT services provided (Hager, Hewlett, et al. 2004). The press release in Georgia showed that more than 90% of transportation users are satisfied with the NEMT services after the implementation of brokerage services (LogistiCare 2001).

Results for the ambulance transport show evidence of decreased ambulance expenditures with the implementation of transportation brokerage services, though not as compelling as the evidence for decreases in NEMT expenditures. The finding suggests that provision of reliable transportation under brokerage services contributed to the decreased use of ambulance transport. For future study, analyses of NEMT use by residential location would help understand whether an increase in NEMT use under transportation brokerage services is associated with increased access for previously underserved areas.

The second and third hypotheses in this analysis—that differential spill-over effects will be found by Medicaid services and by medical conditions—are also confirmed. For both study populations, the increased use of any health care services accompanied with decreased expenditures conditional on any use led to a decrease of total expenditures by $18 per person per month. Compared to average monthly total health care expenditures by study populations, there is evidence of some differences in the magnitudes of effects: 13% decrease in total health care expenditures for children with asthma and 4.4% decrease for adults with diabetes.

Contrary to the findings by Tierney and colleagues (2000), the probability of using outpatient services under transportation brokerage services increased in both study populations. The effect on the use of inpatient services was negative and significant only among children with asthma, which suggest that the predicted substitution effect of outpatient services to inpatient services is supported among children with asthma. The effect on the use of inpatient services among adults with diabetes was positive and not significant. It may be because the adult study sample includes non-elderly disabled dully-eligibles and nursing home users. About 4.5% of nursing home users in the sample could have led to an increased likelihood of inpatient services use. On the other hand, the increased likelihood of inpatient services use could be underestimated because Medicare expenditures of about 13% disabled dually-eligibles in the sample are not accounted for.

Evidence on the last hypothesis concerning health services use, which transportation brokerage services will decrease beneficiaries' ACSC admissions and ER use due to medical conditions, was inconclusive. Effects of transportation brokerage services among adults with diabetes were negative and statistically significant, which means that adults with diabetes have less monthly ACSC admissions. Transportation brokerage services, theoretically, could have reduced use of NEMT among adults with diabetes if brokers deny the services under capitation payment or if there was a huge use of unnecessary transportation services. A larger decrease in unnecessary transportation use can offset increased access to NEMT services (i.e., increase in necessary transportation uses) under transportation brokerage services. The findings of more use of outpatient services and decreased monthly ACSC admissions during the same time period suggest that transportation brokers are not denying the necessary services (i.e., not decreased access to NEMT services) and the access to appropriate health services among adults with diabetes is actually improved.

Effects on children with asthma, however, were mixed and statistically insignificant: more monthly ACSC admissions and less ER use due to asthma. One plausible explanation for increased ACSC admissions among children is that it is hard to avoid first hospital admissions for children with asthma and transportation brokerage services may not significantly affect the likelihood of the first ASCS admission. For children with asthma, transportation brokerage services increased access to NEMT services, which is associated with more use of outpatient services and less use of inpatient services, but there was not sufficient evidence to suggest decreased use of inappropriate health services.

The study has several limitations. First, the study used data from two states, raising concerns about generalizability of the results to other states. The staggered implementation dates of transportation brokerage services between and within states, however, not only controls for general trends in states but also makes stronger study design than simple pre and post design. Second, the magnitude of the effect depends in part on how efficient transportation services were prior to transportation brokerage services. The less efficient fee-for-service transportation was, the more room for improvement by transportation brokerage services. Third, two medical conditions, asthma and diabetes, are analyzed. These conditions are important in terms of beneficiaries' health outcomes and increasing health care costs to individuals and society. The effects could be, however, different in other medical conditions. Further research with additional medical conditions may add more knowledge on the effects of transportation brokerage services. Forth, the analysis on ambulance transport used only Georgia data because Kentucky data did not separately record ambulance transport use. The results are based on the simple pre and post comparisons, but still provide an insight in understanding of substitution effects between NEMT services and ambulance transport. Finally, the medical consumer price index is used to adjust the inflation during the study period. It is possible that inflation adjustment could result in decreased Medicaid expenditures in several types of services because the state Medicaid agencies do not usually update provider reimbursements based on the consumer price index (either medical or regular). The results without any inflation adjustment, however, showed monthly Medicaid expenditures per person were off by about $1 compared to the ones with inflation adjustment, which suggest that using medical price index is not solely contributed to overall decreased Medicaid expenditures.

The policy implications of these findings are clear. Transportation brokerage services were implemented as a cost-containment measure, and the direct and spill-over effects were clearly unknown. Results from this study can inform the policy debate on how to manage NEMT services and whether to expand transportation brokerage services. Capitated reimbursement for NEMT services, in general, decreased cost per person per trip. The elimination of unnecessary NEMT use under decreased cost per trip presumably can lead to greater savings, which could be used to provide access to NEMT services for previously underserved beneficiaries.

It is important to look at the effects of payment change in transportation services on other Medicaid services, as many services are jointly provided and there are spill-over effects. In this study, I find evidence that the shift to transportation brokerage services positively affected the access to care among Medicaid beneficiaries: increased use of any health care services accompanied with decreased associated expenditures. From the beneficiaries' perspective or even a government perspective, policy modification that led to better health outcomes with lower expenditures is unambiguously good. Many states are implementing, or plan to implement, transportation brokerage services to reduce expenditures and improve quality. If access to care and health outcomes are not adversely affected by the transportation brokerage services, then at an aggregated level the decreased overall Medicaid expenditures reflect a more efficient system from an economic perspective, and care may be being shifted to lower-cost providers.

Appendix I:

Ambulatory Care Sensitive Conditions ICD-9 codes

Ambulatory Care Sensitive Conditions	ICD-9 codes
Congenital syphilis	090
Immunization-related and preventable conditions	033, 037, 045, 320.0, 390, 391
Grand mal status and other epileptic convulsions	345
Convulsions "A"	780.3
Convulsions "B"	780.3
Severe ear, nose, and throat infections	382, 462, 463, 465, 472.1
Pulmonary tuberculosis	011
Other tuberculosis	012-018
Chronic obstructive pulmonary disease	491, 492, 494, 496, 466.0
Bacterial pneumonia	481, 482.2, 482.3, 482.9, 483, 485, 486
Asthma	493
Congestive heart failure	428, 402.01, 402.11, 402.91, 518.4
Hypertension	401.0, 401.9, 402.00, 402.10, 402.90
Angina	411.1, 411.8, 413
Cellulites	681, 682, 683, 686
Skin grafts with cellulites	263, 264
Diabetes "A"	250.1, 250.2, 250.3
Diabetes "B"	250.8, 250.9
Diabetes "C"	250.0
Hypoglycemia	251.2
Gastroenteritis	558.9
Kidney/urinary infection	590, 599.0, 599.9
Dehydration - volume depletion	276.5
Iron deficiency anemia	280.1, 280.8, 280.9
Failure to thrive	783.4
Pelvic inflammatory disease	614
Dental Conditions	521, 522, 523, 525, 528

Source: Billings, J., L. Zeitel, J. Lukomnik, T.S. Carey, A.E. Blank, and L. Newman. 1993. "Impact of socioeconomic status on hospital use in New York city." *Health Affairs*, 12:1, pp.162-73. The list is accessed at http://www.ahrq.gov/data/safetynet/billappb.htm

Note: Where only three digits are listed, all diagnoses at the 4th and 5th digit should be included (e.g., asthma is listed as 493, but you should include 493.0, 493.00, 493.01, 493.1, 493.10, 493.11, etc.). Where only four digits are listed, all diagnoses at the 5th digit should also be included.

Appendix II:

Medication list for asthma and diabetes

Medical conditions	Medication
Asthma	Albuterol Accolate Advair Aerobid Aminophylline Cromolyn solution Dyphylline Epinephrine Foradil aerolizer Isoproterenol Ipratropium Metaproterenol Prednisolone Pulmicort Turbulaer Singulair Terbutaline Theophylline Tronalater Vanceril Xopenex
Diabetes	Sulfonylureas (Chlopropamide, Acetohexamide, Tolazamide, Tolbutamide, Glipzide, Glimepiride, Glyburide) Alpha-Glucosidase Inhibitors (Acarbose, Miglitol) Biguanides (Metformin) Meglitinides (Repaglinide, Nateglinide) Thiazolidinediones (Rosiglitazone, Pioglitazone, Troglitazone) Glyburide/Metformin Glipizide/Metformin Rosglitazone/Metformin

REFERENCES

Ai, C.R. and Edward C. Norton. 2000. "Standard errors for the retransformation problem with heteroscedasticity." *Journal of Health Economics*, 19:5, pp. 697.

Arcury, T. A., W. M. Gesler, J. S. Preisser, J. Sherman, and J. Perin. 2005. "The effects of geography and spatial behavior on health care utilization among the residents of a rural region." *Health Services Research*, 40:1, pp. 135-55.

Baren, J. M., F. S. Shofer, B. Ivey, S. Reinhard, J. DeGeus, S. A. Stahmer, R. Panettieri, and J. E. Hollander. 2001. "A randomized, controlled trial of a simple emergency department intervention to improve the rate of primary care follow-up for patients with acute asthma exacerbations." *Annals of Emergency Medicine*, 38:2, pp. 115-22.

Billings, J., G. M. Anderson, and L. S. Newman. 1996. "Recent findings on preventable hospitalizations." *Health Aff (Millwood)*, 15:3, pp. 239-49.

Billings, J., L. Zeitel, J. Lukomnik, T. S. Carey, A. E. Blank, and L. Newman. 1993. "Impact of socioeconomic status on hospital use in New York City." *Health Aff (Millwood)*, 12:1, pp. 162-73.

Billittier, A.J., R. Moscati, D. Janicke, E. B. Lerner, and D. Olsson. 1996. "A multisite survey of factors contributing to medically unnecessary ambulance transports." *Academic Emergency Medicine*, 3:11, pp. 1046-52.

Bindman, A., K. Grumbach, D. Osmond, M. Komaromy, K. Vranizan, N. Lurie, J. Billings, and A. Stewart. 1995. "Preventable hospitalizations and access to health care." *Journal of American Medical Association*, 274:4, pp. 305-11.

Brown, E. and J. Sindelar. 1993. "The emergent problem of ambulance misuse." *Ann Emerg Med*, 22:4, pp. 646-50.

Broxterman, K., R. Sapien, L. Fullerton, L. Olson, and D. Sklar. 2000. "Repeat ambulance use by pediatric patients." *Acad Emerg Med*, 7:1, pp. 36-41.

Bureau of Labor Statistics. 2004. "Consumer price index - all urban consumers." Vol. 2004. U.S. Department of Labor.

Camasso-Richardson, K., J. A. Wilde, and E. M. Petrack. 1997. "Medically unnecessary pediatric ambulance transports: a medical taxi service?" *Acad Emerg Med*, 4:12, pp. 1137-41.

CMS. 2004. "Medicaid managed care enrollment report: 1996-1999." Centers for Medicare and Medicaid Services.

Dai, Chifeng. 2005. "The efficiency of organizational forms: Evidence from Florida's non-emergency Medicaid transportation programs." *Submitted to publication*.

Donaldson, M.D., K.D. Yordy, K.N. Lohr, and N.A. Vanselow. 1996. *Primary Care: America's Health in a New Era*. Washington, DC: National Academy Press.

Duan, N., W.G. Manning, C.N. Morris, and J.P. Newhouse. 1984. "Choosing between the sample-selection and multi-part model." *Journal of Business and Economic Statistics*, 2:3, pp. 283-89.

Fortney, J., D. E. Teffick, J.F. Burgress, M. L. Maciejewski, and L. A. Petersen. 2005. "Are Primary Care Services a substitute or Complement for Specialty and Inpatient Services?" *Health Services Research*, 40:5, pp. 1422-42.

Gaskins, D. J. and C. Hoffman. 2000. "Racial and ethnic differences in preventable hospitalizations across 10 states." *Medical Care Research and Review*, 57:Suppl 1, pp. 85-197.

Hager, Greg., T. Hewlett, L. Atchley, and S. Otto. 2004. "Human service transportation delivery: system faces quality, coordination, and utilization challenges." *Research Report No.319*: Fankfort, Kentucky.

Johnson, W.G. and M.E. Rimsza. 2004. "The Effects of Access to Pediatric Care and Insurance Coverage on Emergency Department Utilization." *Pediatrics*, 113, pp. 483-7.

Kim, Jinkyung and Edward C. Norton. 2004. "LogistiCare Interview." University of North Carolina at Chapel Hill.

Kulkarni, Manjusha P. 2000. "Fact Sheet: Medicaid transportation services." National Health Law Program.

LogistiCare. 2001. "Medicaid recipients pleased with non-emergency transportation (Georgia)." LogistiCare, Inc.: College Park, GA.

Manning, W.G., J.P. Newhouse, and W.H. Rogers. 1987. "Health Insurance and the Demand for Medical Care: Evidence from a Randomized Experiment." *American Economic Review*, 77:3, pp. 251-77.

Messeri, P.A., D.M. Abramson, A. Aidala, F. Lee, and G. Lee. 2002. "The impact of ancillary HIV services on engagement in medical care in New York City." *AIDS Care*, 14:Supplement 1, pp. S15-S29.

Mofidi, M., R. G. Rozier, and R. S. King. 2002. "Problems with access to dental care for Medicaid-insured children: What caregivers think." *American Journal of Public Health*, 92:1, pp. 53-58.

Murdock, T. C., J. F. Knapp, M. D. Dowd, and J. P. Campbell. 1999. "Bridging the emergency medical services for children information gap." *Arch Pediatr Adolesc Med*, 153:3, pp. 281-5.

Nemet, G. F. and A. J. Bailey. 2000. "Distance and health care utilization among the rural elderly." *Social Science & Medicine*, 50:9, pp. 1197-208.

O'Connell, Lenahan, T. Grossardt, B. Siria, S. Marchand, and M. McDorman. 2002. "Efficiency through accountability: some lessons from Kentucky's improved Medicaid transit service." *Journal of Transportation and Statistics*, 5:2/3.

OIG. 1997. "Controlling Medicaid Non-Emergency Transportation Costs." Office of Inspector General, U.S. Department of Health and Human Services.

Pappas, G., W. C. Hadden, L. J. Kozak, and G. F. Fisher. 1997. "Potentially avoidable hospitalizations: inequalities in rates between US socioeconomic groups." *American Journal of Public Health*, 87:5, pp. 811-6.

Rafael, D. 1997. "Managing Medicaid Transportation: A manual Examining innovative service delivery models under state Medicaid managed care plans." Community Transportation Association of America (CTAA): Washington, D.C.

Rafael, D. 2001. "Medicaid Transportation: Assuring access to health care. A primer for states, health plans, providers and advocates." Community Transportation Association of America (CTAA): Washington, D.C.

Saunders, C. E. 1987. "Patient compliance in filling prescriptions after discharge from the emergency department." *Am J Emerg Med*, 5:4, pp. 283-6.

Starfield, B. 1994. "Is Primary Care Essential?" *Lancet*, 344:8930, pp. 1129-33.

Starfield, B. 1996. "A Framework for Primary Care Research." *Journal of Family Practice*, 42:2, pp. 181-5.

Tierney, W. M., L. E. Harris, D. L. Gaskins, X. H. Zhou, G. J. Eckert, A. S. Bates, and F. D. Wolinsky. 2000. "Restricting Medicaid payments for transportation: Effects on inner-city patients' health care." *American Journal of the Medical Sciences*, 319:5, pp. 326-33.

Weinberger, M., E.Z. Oddone, and W.G. Henderson. 1996. "Does Increased Access to Primary Care Reduce Hospital Readmissons?" *New England Journal of Medicine*, 334:22, pp. 1141-7.

Weissman, J.S., C. Gatsonis, and A. M. Epstein. 1992. "Rates of avodiable hospitalization by insurance status in Massachusetts and Maryland." *Journal of American Medical Association*, 268, pp. 2388-94.

Wilson, G., P. Nutt, L. Atchley, D. Huddleston, M. Clark, T. Hewlett, and J. Hood. 2000. "Progress report on coordinated human service transportation system." Legislative Research Commission, Program Review and Investigations Committee: Frankfort, Kentucky.

Wilson, K. M. and D. K. Jonathan. 2000. "Adolescents Who Use the Emergency Department as Their Usual Source of Care." *Archives of Pediatrics and Adolescent Medicine*, 154, pp. 361-5.